

WHAT IS CLAIMED IS

1. A method of producing chlorine dioxide (ClO_2), comprising:
reducing alkaline chlorate in a reaction with urea in a mineral acid medium to produce
5 ClO_2 at or below normal atmospheric pressure.
2. A method according to claim 1 wherein the alkaline chlorate is NaClO_3 or KClO_3 .
3. A method according to claim 2 wherein the mineral acid is selected from the group
10 consisting essentially of sulfuric acid, nitric acid, phosphoric acid and hydrochloric acid.
4. A method according to claim 3 wherein a reducing agent is Urea.
- 15 5. A method according to claim 4 wherein below atmospheric pressure about 100 to about 400mm Hg.
6. A method according to claim 5 comprising controlling a mol ratio of alkaline chlorate and mineral acid to be between about 0.2 to about 0.8 in the reaction.
- 20 7. A method according to claim 6 comprising controlling a mineral acid concentration of the reaction to be between about 3 mol-L^{-1} to about 10 mol-L^{-1} .
8. A method according to claim 7 comprising controlling a mol ratio of alkaline chlorate and Urea in the reaction to be between about 2 to about 4, except that in hydrochloric
25 acid medium, the mol ratio is about 0.84.
9. A method according to claim 8 comprising controlling a temperature of the reaction to be between about 40°C to about 90°C .
- 30 10. A method according to claim 9 comprising controlling a temperature of the reaction to be between about 55°C to about 85°C .

11. A method of producing chlorine dioxide (ClO_2) and at least one inorganic salt, comprising:
reducing alkaline chlorate in a reaction with urea as reducing agent in a mineral acid medium to produce ClO_2 ; then,
5 adding an alcohol as salting out reagent to the medium; and,
collecting an inorganic salt.
12. A method according to claim 11 wherein the alcohol is selected from the group consisting essentially of methanol, ethanol, and propanol.
- 10 13. A method according to claim 12 wherein the alkaline chlorate is NaClO_3 or KClO_3 , and the mineral acid is selected from the group consisting essentially of sulfuric acid, nitric acid, phosphoric acid and hydrochloric acid.
- 15 14. A method according to claim 13 wherein the inorganic salt is selected from the group consisting essentially of potassium sulfate, potassium nitrate, and sodium nitrate.
15. A method of producing chlorine dioxide (ClO_2) and at least one binary/ternary compound fertilizer, comprising:
20 reducing alkaline chlorate in a reaction with urea as a reducing agent in a mineral acid medium to produce ClO_2 ; then,
adding urea (or other nitrogenous fertilizer), phosphorus ore powder/phosphate fertilizer (amount based on the acid concentration of mother solution), and/or kali salt to the medium; and,
25 collecting a compound fertilizer.
16. A method according to claim 15 wherein the alkaline chlorate is NaClO_3 or KClO_3 and the mineral acid is selected from the group consisting essentially of sulfuric acid, nitric acid, phosphoric acid and hydrochloric acid.
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